

Farnell

FARNELL OSCILLOSCOPES MODELS DT12-5, DTV12-14 AND DTC12

INSTRUCTION BOOK

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FARNELL OSCILLOSCOPES MODELS DT12-5, DTV12-14 AND DTC12

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SCHEDULE OF EQUIPMENT

The instrument has been carefully packed to prevent damage in transit. When removing the unit from the packing box, be sure that all parts and accessories are removed from the packing material.

The complete equipment comprises:-

1 off DT12-5, DTV12-14 or DTC12 as ordered
1 off instruction book
1 off COMPONENT TEST handbook
1 off pair of test leads 1.5m red and black
1 off pair of insulated crocodile clips
1 off pair of probes

] supplied with DTC12 only

NOTE:- In the event of damage in transit or shortage in delivery, separate notices in writing should be given to both the carriers and Farnell Instruments Ltd., within three days of receipt of the goods, followed by a complete claim within five days. All goods which are the subject of any claim for damage in transit or missing items should be preserved intact as delivered, for a period of seven days after making the claim, pending inspection instructions from Farnell Instruments Ltd., or an agent of this Company.

INTRODUCTION

The Farnell DT12-5, DTV12-14 and DTC12 oscilloscopes are two channel 12MHz bandwidth oscilloscopes each with a display of 8 × 10div (5" diagonal tube) yet the overall size of each unit is only 170× 280×330 (310 for DT12-5)mm. Much of the space saving has been achieved by using a short necked wide angle CRT. Model DTC12 incorporates a COMPONENT TEST facility.

Particular attention has been paid to the triggering which is consistently good for a wide variety of measurement conditions. It will trigger from either channel in several modes at the touch of a button and accommodates the viewing of TV waveforms by relating trigger mode to TV sync. signals. If the sweep rate is low enough to display the TV frame (field) signal then the trigger circuit is automatically switched to repsond to frame sync. pulses. When the sweep speeds are in the microsecond range a trigger circuit sensitive to line sync. is used.

Dual trace display is available in chopped or alternate modes, the most appropriate mode being automatically selected by the timebase switch. The same switch may be used to select XY facility. The X channel has a x5 trace expansion for detailed examination of sections of displays. The internal graticule permits accurate measurement of the display by the elimination of parallax error in both x1 and x5 modes

The layout of the front panel has been designed for ease of comprehension and use, with logically and clearly marked groups of controls.A simple rack mounting facility can also be supplied.

The DTV12-14 and DTC12 have all the features of the DT12-5, with the addition of fine controls on sweep speed and Y amplification so that continuous interpolation between the fixed switch settings is possible. Two further facilities allow for the inversion of one of the channels and the algebraic addition of the two inputs, also permitting difference measurements to be made when both facilities are used in conjunction.

Component test facility (DTC12 only)
A separate handbook is provided with the DTC12 and provides a user guide to testing solid-state devices in or out of circuit. Characteristic waveforms or 'signatures' of good and bad components are shown and there is provision for the user to record his own waveforms.

SPECIFICATION

Vertical deflection

Two identical input channels

BANDWIDTH	D.C. coupled: DC-12MHz (-3dB @ 4 div deflection) A.C. coupled: 2Hz-12MHz (-3dB @ 4 div deflection)
RISE TIME	<29ns at 4 div deflection
SENSITIVITY	5mV/div to 10V/div in 11 calibrated ranges (1-2-5 sequence). Fine control extends factor to greater than 20V/div on DTV12-14.
ACCURACY	±3% with fine control in Cal. position
INPUT IMPEDANCE	1MΩ & 30pF nominal in parallel
COUPLING	A.C. or D.C. with provision for grounding the input to the attenuator or turning the channel OFF.
MAX INPUT VOLTAGE	400V d.c. + a.c. peak

Display modes

SINGLE TRACE	Channel 1 or Channel 2 only. OFF position for unused channel on AC-DC-GND switches. Chopped or alternate. Automatically selected by timebase switch. Nominal chop frequency 100kHz. Alternate above 1ms/div.
CH1 + CH2 (DTV12-14, DTC12)	The signals from each input channel can be added, and the sum displayed on a single trace.
CH2 INVERT (DTV12-14, DTC12)	The Ch2 signal can be inverted i.e. positive going signals cause downward trace deflection
DIFFERENTIAL MEASUREMENT (DTV12-14, DTC12)	The two facilities given above enable Ch1-Ch2 differential signals to be displayed on a single trace

COMMON-MODE REJECTION (DTV12-14, DTC12)	34dB up to 1MHz rejection of common-mode signals which represent less than 10cm deflection viewed separately
X-Y	Channel 1 is used to provide X-deflection with same calibrated sensitivity as for Y operation, d.c. or a.c. coupled. Bandwidth is d.c. to 800kHz. Phase difference between X and Y channels is 10° max. at 100kHz

Horizontal deflection

MODE	Either internal timebase or with Ch1 providing X deflection in X-Y mode-selected on timebase switch
TIMEBASE:	
SWEEP SPEEDS	0.5µs/div to 0.5s/div in 19 calibrated ranges (1-2-5 sequence). Use of x 5 expansion extends fastest sweep to 100ns/div.
FINE CONTROL (DTV12-14, DTC12)	Extends slowest sweep to greater than 1s/div, and provides continuous sweep speed adjustment between the calibrated positions
EXPANSION	×5 magnifier operated by push-button switch. Affects timebase only—inoperative in X-Y mode
ACCURACY	±3% all speeds, except 0.5µs/div @ ±5% ±5% on all speeds in ×5 expanded mode, except 0.5µs/div @ ±10%

Triggering

SOURCE	Channel 1, Channel 2, or External
NORMAL MODE	Sweep triggering only when signal is present
AUTO MODE	Sweep free runs in absence of suitable signal, with signal triggering the same as Normal mode
SLOPE	Triggering from positive or negative going signals may be selected by + / - switch

COUPLING	A.C. only, or via T.V. sync-separator
LEVEL	Variable trigger level control with adjustment over full 8cm equivalent deflection
SENSITIVITY	Internal<0.5 div 40Hz to 2MHz <2 div 8Hz to 40Hz & 2MHz to 15MHz External <1V 40Hz to 0.1MHz <5V 8Hz to 40Hz & 0.1MHz to 15MHz
EXTERNAL	Separate front-panel input, impedance >100kΩin parallel with 30pF
TV	This mode provides fully automatic triggering from normal or inverted T.V. video signals. Internal sync. separator triggers sweep from either Line or Frame sync. pulses depending on timebase setting. Triggers from Line pulses at 50µs/cm and faster

Auxiliary feature

CALIBRATOR	Front panel socket (2mm) provides 1V ± 2% pk-pk square wave at a nominal 1kHz. This may be used for probe compensation or to check Y amplifier gain
Z MODULATION/BLANKING	Rear panel 4mm socket. An input pulse of + 5V will blank the trace. This facililty is a.c. coupled
TRACE ROTATE	Adjustment by rear panel operated control.
ASTIGMATISM	Adjustment by rear panel operated control

General

C.R.T.	5 in. diagonal rectangular faced tube with internal graticule 8 x 10 div with 5 sub-divisions along central axes. Mono-accelerator working at 2kV. Medium persistance P31 phosphor.
POWER SUPPLY	110, 120, 220, 240V a.c. inputs ± 10% by internal tap change. 50-60Hz. Power consumption 60VA. Stabilised against power line variation of ± 10%.
FUSE RATINGS	190-260V inputs. 500mA anti-surge. 95-130V inputs. 1A anti-surge
TEMPERATURE	Ambient temperature operating range 0 to 45°C. Specification valid for operation in range 15 to 35°C.
OPTIONS (TO ORDER)	Probe kit with × 1, GND, × 10 positions, full spec. on request. Rack mounting kit Soft carrying case for protection in transit
ACCESSORIES (SUPPLIED)	Handbook

DIMENSIONS (OVERALL)mm.

Model	Height	Width	Depth	Weight
DT12-5	170	280	310	7 kg
DTV12-14	170	280	330	7 kg
DTC12	170	280	330	7.5 kg

OPERATING INSTRUCTIONS

Installation

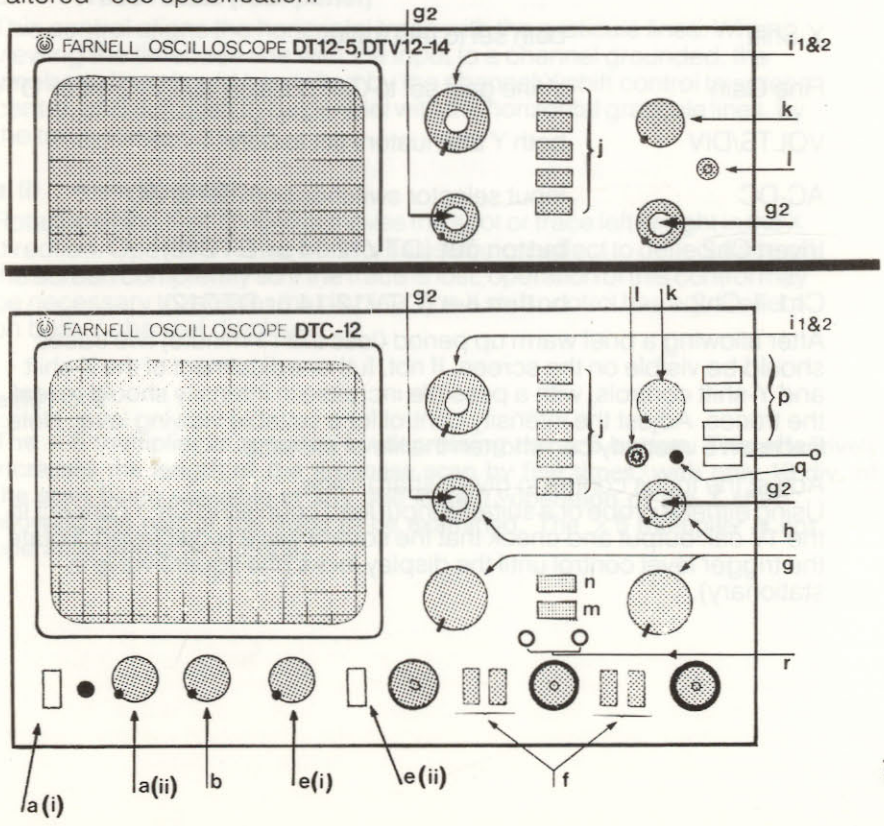
The voltage to which the unit is set prior to despatch is printed on the rear of the unit. Check that this voltage corresponds to the available a.c. supply.

To alter the mains setting it is necessary to remove the cover of the instrument and solder the mains lead to the correct taps on the mains transformer. There are two primary windings, both 0-110-120V. By wiring in series appropriate sections, 220, 230 and 240V nominal mains supply can be accomodated and by paralleling the appropriate sections 110 or 120V operation can be catered for.

The three core mains lead must be connected as follows:-

Brown	-	Mains live
Blue	-	Mains neutral
Green/yellow	-	Earth (ground)

Always check the value of the mains fuse if the mains tapping has been altered - see specification.



First time operation

Connect the instrument to the a.c. supply and switch on the unit by depressing 'on' button and rotating the intensity control clockwise through approximately ¾ of its total travel. The adjacent l.e.d. mains indicator should light. Set the controls as follows:-

TIME/DIV	to 0.2ms
Fine Sweep	to Cal. position (DTV12-14 or DTC12)
TRIGGER level	to mid travel
TRIGGER mode	Auto-Norm button to Auto (out) AC-TV button to AC (out) '+' '−' button to + (out) Ch1 button depressed Ch2 button out
X Shift	set to mid travel
Y Shift	both set to mid travel
Fine Gain	Y fine gain set to Cal. position (DTV12-14 or DTC12)
VOLTS/DIV	both Y attenuators set to 0.2V
AC-DC	input selector switches both set to DC
Invert Ch2	button out (DTV12-14 or DTC12)
Ch1 + Ch2	button out (DTV12-14 or DTC12)

After allowing a brief warm up period (less than 1 minute) two traces should be visible on the screen. If not, futher adjustment of the X-shift and Y-shift controls, with a possible increase in intensity should reveal the traces. Adjust the intensity control for a suitable viewing level. Note: Excessive intensity can shorten the life of the tube.

Adjust the focus control to give a sharp trace.
Using either a probe or a suitable input lead coupled to Ch.1 connect to the 1V cal. output and check that the square wave is displayed. Rotate the trigger level control until the display locks (the square wave is stationary).

OPERATION OF CONTROLS

Refer to diagram on page 7

a.(i) On/Off

Depressing the push-button switches the oscilloscope on.

a.(ii) Intensity

This varies the brightness of the trace.

NOTE: *Excessive intensity can shorten the life of the tube.*

b. Focus

This varies the fineness of the trace.
NOTE: *It is normal for the trace to defocus at excessive intensity.*

c. Astigmatism (rear panel)

This control is best adjusted in conjunction with the focus control while viewing a sinewave to give best fineness of trace in both the X and Y directions.

d. Trace rotate (rear panel)

This control aligns the horizontal trace with the graticule lines. When viewing the timebase line with the input to a channel grounded, the timebase line should be shifted by the channel Y shift control to screen centre, and adjusted to be parallel with the horizontal graticule lines, by the trace rotate control.

e.(i) ←→ (X-shift)

Rotation of the X-shift control moves the spot or trace left or right in the X direction. Operation of the control has sufficient effect to deflect trace off the screen completely so if the trace is lost, operation of this control may be necessary to recover the display. The X shift control has equal effect on both Y channel displays.

e.(ii) ×5

The ×5 multiplier is operated by depressing the ×5 button. This effectively increases the length of the timebase scan by five times, with only 10 div. of the scan being viewable at any one instant, operation of the X shift allowing the rest of the trace to be examined. The ×5 multiplier is not operative in the X-Y mode.

f. Input mode selector buttons - identical operation on each channel

These provide four separate possibilities according to which buttons are depressed.

AC - The input to the channel is capacitively coupled, blocking d.c. up to 400V and giving a bottom end frequency response down to 2Hz.

DC - The input is directly coupled to the amplifier allowing d.c. levels to be displayed as well as a.c. signals.

GND (both buttons in) - The input to the amplifier of the channel concerned is disconnected from the input socket and is connected to signal ground. The input signal is not shorted to ground but left open-circuit.

OFF (both buttons out) - The channel is turned off and only the other channel is displayed. It is still possible however to trigger from a signal input to a channel which is turned off. This facility may be particularly useful where it is desired to measure time delays between infrequently occurring events in different parts of a circuit viewed on each channel. The alternate beam switching may then cause the second event to be missed, but using Ch.1 as reference to trigger the timebase while turned off will ensure that the second event coupled to Ch.2 will not be missed. **NOTE:** It is an invalid mode to have both Ch.1 and Ch.2 switched off.

g. (i) Y-channel attenuator switches

These switches adjust the input sensitivity of the Y channels, in conjunction with fine gain controls on the DTV12-14. If a squarewave of amplitude 1V pk-pk is coupled directly to channel 1 input with d.c. selected and the attenuator switch set to 1V/div. then the waveform displayed will be 1 div. high. If the attenuator is set at 0.2V/div. then the displayed waveform will be 5 div. high. By using the range switch position in combination with the internal graticule, which has minor divisions marked on the X and Y axes every 0.2 div., the peak to peak voltage of any waveform can be determined. For example: a waveform measuring 4.8 div. in amplitude with the attenuator set to the 0.5V/div. range has peak to peak voltage of 2.4V.

On DTV12-14 it is important to ensure that the fine gain control is in the cal. position, fully clockwise, before accurate measurements are made.

(ii) Y - fine gain (DTV12-14 or DTC12)

These potentiometer controls are located concentrically with the Y shift controls for each channel. At the extreme clockwise end of rotation a slight mechanical detent indicates that the control is in the calibrated position, with Y deflection sensitivity being as indicated on the Y attenuator switch setting. Anticlockwise rotation from this position reduces the Y sensitivity, ultimately to a value less than the next switch position of anticlockwise rotation of the attenuator control.

h. ↕ Y-shift

These controls move the trace for the respective channel in a vertical (Y) direction. It is possible to move the trace right off the screen in either direction. This can be used to observe a.c. components on top of larger d.c. offsets whilst still d.c. coupled. The Y shift on channel 1 is rendered inoperative in the X-Y mode. The X shift can be used as normal.

i. (i) Time/div

Apart from the X-Y position, this switch allows selection of a choice of 19 different sweep speeds from 0.5us/div. to 5s/div (without the x5 expansion). This allows the time between events to be measured along the X axis of the internal graticule in the same way voltage was determined on the Y scale (see g above).

On the DTV12—14 it is important to ensure that the fine sweep control is in the Cal. position, fully clockwise, before accurate measurements are made.

The frequency of repetitive waveforms can be measured in one of two ways. 1) If the distance between two identical portions of successive waveforms is measured, e.g. from one positive peak to the next, as say 2.5 div. on the 50µs/div. range, the length represents 2.5 x 50= 125µs, the reciprocal of which gives a frequency of 8kHz. 2) A simpler, but more approximate method is to set the timebase range to one of the decimals of unity e.g. 1, .1ms/div. etc. and simply count the number of complete waveforms displayed across the screen, divide by ten and multiply by the reciprocal of the timebase range.

In the X-Y position the timebase is disabled and the output from the channel 1 Y amplifier is switched through to the X amplifier, maintaining the same deflection sensitivity in terms of volts per div., but at a reduced bandwidth.

The Ch.2 Y amplifier is automatically switched through to the Y amplifier. In this way the oscilloscope may be used to generate X-Y displays.

NOTE: The Ch.1 Y-shift control becomes inoperative in X-Y mode, and the X shift control should be used as normal

(ii) Fine Sweep (DTV12-14 or DTC12)

This variable potentiometer control is located concentrically with the timebase switch. At the extreme clockwise end of rotation a slight mechanical detent indicates that the control is in the calibrated position with the time per division being as indicated on the timebase switch setting. Anticlockwise rotation from this position increases the time per division, i.e. slows the sweep speed, ultimatly to a value less than the next switch position of anticlockwise rotation of the timebase switch.

j. Trigger mode switches

These switches control the various ways in which the timebase can be triggered. The legends printed in red indicate the function selected with the button out, and those in black the function with the button in.

(i) Auto/Norm

In the 'Norm' (in) position a timebase sweep will only be initiated if there is a signal present to trigger it, and only then if the correct input has been selected and the level control adjusted correctly (see k). In 'Auto' if a suitable trigger is not received within approx. 0.1s from the end of the last sweep then a sweep is automatically initiated. If no trigger signal is present then the displayed signal will not lock. So long as a suitable signal is applied which triggers the timebase, then sweeps will be triggered as in the 'Norm' mode. The only exception here is with infrequently repetitive signals of less than approx. 10 per second, in this case it is essential to use 'Norm' mode to obtain a locked display.

(ii) A.C./T.V.

For most input signals 'AC' (out) should be selected, this a.c. couples the signal to the trigger circuit. For examining television video signals, a special TV sync separator circuit has been provided which is selected by pressing in the AC/TV mode button. This then triggers the sweep from the frame sync pulses, or the line sync pulses at timebase speeds above 100µs/div. **NOTE:** If the video is inverted (sync pulses positive going) then '-' should be selected.

(iii) '+/−'

With 'AC' and '+' (button out) selected, sweeps will be triggered by positive going (rising) edges. By selecting 'AC' mode and '−' (button in) negative going edges trigger the sweep. In TV mode '+' should be selected for normal video and '−' for inverted video signals.

(iv) Ch 1

When 'Ch 1' trigger button is depressed the signal applied to channel 1 is routed to the trigger circuit - even if its Y channel is 'Off'.

(v) Ch 2

When 'Ch 2' trigger button is depressed the signal applied to channel 2 is routed to the trigger circuit - even if its Y channel is 'Off'.

(vi) Ext. Selected when both 'Ch 1' and 'Ch 2' trigger buttons are out together

This then routes a signal applied to the 'Ext. Trigger' socket to the trigger circuit.

k. Trigger level

This control is used in conjunction with the mode switches, particularly the '+/−' switch and it determines the point on the waveform from which a sweep is initiated. Adjustment of this control will move the point from which the waveform starts up or down the rising or falling edge (dependent upon selection of +/−). For waveforms which do not occupy the full height of the screen it is possible to adjust the trigger point beyond the amplitude of the waveform either positively or negatively, in which case synchronism will be lost. Readjustment of the control should enable lock to be restored. Note: As there is no signal delay line in this oscilloscope, a delay between the signal initiating the trigger and the observed start of the trace causes an apparent shift in the trigger point at the fastest timebase speeds. This delay is approximately 160ns.

l. 1V Cal.

This socket provides a square wave output at a frequency of approximately 1kHz and an amplitude of 1V pk-pk from a source resistance of approximately 2kΩ. The purpose of this output is to aid the correct adjustment of the high frequency compensation in dividing type oscilloscope probes. This socket is positioned slightly to the left on model DTC12

m. Ch1 + Ch2 (DTV12-14 or DTC12)

This push button when depressed displays the algebraic sum of the signals presented to the two input channels, modified by the deflection factors to which the input attenuators are set. Since any offset introduced by the shift control is also included in the summation, it is best to view each channel before depressing the Ch1 + Ch2 button to ensure that each is positioned such that less than 50% of the waveform at most is off-screen. If it is desired to view also the summation of the d.c. components then the first action should be to depress the input selector buttons for each channel to ground the input and then adjust the traces to mid-screen using the shift controls, finally select d.c. coupling. Deflection sensitivity should be adjusted as desired within the proviso of a maximum deflection no greater than 150% of full screen deflection. Normally it will be desirable to have both channel attenuator switches set to the same deflection factor, otherwise the displayed summation may prove confusing to interpret. When the Ch1 + Ch2 function is selected only the summation appears, therefore only one trace is displayed.

n. Invert Ch2 (DTV12-14 or DTC12)

This facility inverts the display of Ch2 waveforms such that positive going inputs cause downward deflection of the trace on the display. This facility is most frequently used in conjunction with the Ch1 + Ch2 summation facility described above so that the difference between the input to the two channels is displayed i.e. Ch1-Ch2. It should be noted when looking for small differences between similar signals that the sensitivity of each channel should not be increased beyond the point where either channel when viewed separately would cause a deflection of more than 150% of full screen height.

o. Component test off switch (DTC12 only)

This push button must be in the OFF position (out) when the DTC12 is being used as a conventional oscilloscope.

p. Component test range switches (DTC12 only)

Consult separate handbook provided only with DTC12

q. 'Expand' LED (DTC12 only)

Should only light when Component Test facility is being used and then only under certain conditions when using the LO impedance component test range button. See separate handbook.

r. CT probe sockets (DTC12 only)

Consult separate handbook.



CIRCUIT DESCRIPTION

CAUTION. Personnel attempting maintenance or servicing these oscilloscopes should take care as there are high voltages present within the unit at many points, particularly, but not only, in the vicinity of the cathode ray tube.

NOTE: The insulating washers used in the mounting of power transistors on the rear of the heat sink flange at the rear are of *Beryllia* which can be *highly toxic* if consumed, or if dust from a crushed or broken washer is inhaled. Take great care when servicing to avoid losing these washers, or in the event of disposal ensure that they are treated as toxic waste.

General description and location of parts

The circuit is divided into a number of separate functional parts for the purposes of this description, and the physical location of these parts is as follows.

The input signals to Y channels are taken to separate attenuators mounted on the front panel rotary switches. The input F.E.T. stage following the passive attenuator and the succeeding impedance transforming transistors and pre-amplifiers are mounted on small circuit boards beneath the attenuator switches each of which is completely housed in a screening box. Access to these can only be easily gained by withdrawing the module, which the two input attenuators comprise, out through the front panel, after first removing the front panel legend escutcheon. See Recalibration section.

The input Y amplifiers are both on the main, horizontally mounted circuit board to the right of the vertically mounted 'trigger' board. The main Y amplifier is at the rear of the main circuit board behind the C.R.T.

The trigger circuitry together with the selector switches and timebase generator are all to be found on the vertically mounted board, with the exception of the timebase timing resistors which are on a small board on the back of the timebase switch.

The timebase ramp is fed to the main X amplifier which is located on the horizontal circuit board to the right of the C.R.T. The blanking information is also fed to the blanking amplifier mounted centrally at the rear of the large crcuit board.

The low voltage power supply is fully stabilised by integrated circuit regulators mounted on the rear heatsink flange under the mains transformer.

The EHT tripler and regulator components are mounted underneath the C.R.T.

Y attenuators and input amplifiers

The input stages for Ch1 and Ch2 are identical. The input attenuator consists of four passive sections switched in various combinations to obtain the desired attenuation. A preamplifier using a matched dual F.E.T. follows the attenuator. One of the F.E.T.s forms a source follower, with the other used as a constant current tail to keep the gain close to unity and maintain good d.c. temperature stability. The d.c. balance is trimmed by adjusting this current using P1.

The output of the F.E.T. stage is fed via an emitter follower **TR3** to give a low impedance drive to the amplifying stage formed with **TR4** as a common emitter feeding **TR5** as a common base stage. The gain of this configuration is determined by R20 and series combination of R23 and P2.

Calibration is adjusted by means of P2. The output from this stage is fed via screened cable to the input of the trigger and beam switching stages on the main board.

Y beam switching and output

Further Y amplification and variable gain are obtained with the differential amplifier stages **TR150, 153 and 154 (Ch 1) and TR250, 253** 254 (Ch2). **TR256** and 257 are constant current tails for Ch2 stage. **TR150** and 250 amplify and separate the signal from the trigger circuits.

Beam switching is achieved by **TR151** and 152 (Ch1) and **TR251**, 252, 259 and 260 (Ch2). **TR259** and 260 are in operation when Ch2 'Invert' is selected.

TR258 is used to form a constant current source to provide the same biasing into the main Y amplifier when in the Ch1 + Ch2 mode as when in the normal mode. The selected signal (or both simultaneously if Ch1 + Ch2 is selected) is fed to the Y output stage which also operates as a feedback amplifier with the input to **TR302 being a virtual earth point.**

TR304 and 305 act as a constant current tail for differential amplifier **TR302** and 303, which in turn feeds high voltage transistors **TR306** and 307 in a common base connection. The output of these each goes to an emitter follower, **TR308** and 309, providing a low impedance drive to the Y plates,and feedback resistors R301 and R325. Z301 prevents the emitter followers from saturating, likewise **TR307** by diodes D301 to 304,

X amplifier and output

TR507 and TR508 combine to form the X driver amplifier. Feedback via R522 to the virtual earth point at the base of **TR508 allows the gain to be** varied for the x5 expansion facility, and for calibrating X-Y gain by varying the input resistance to this stage. Switching to x5 expansion parallels R514 with R520 and P506 which calibrates the x5 gain. The X-Y input is fed through R513 and P505, the latter is used to calibrate X gain in the X-Y mode.

The X-plate driver amplifier is a conventional differential amplifier with **TR**503 and 504 as constant current tails. **TR501 and TR505 form the** differential pair driving **TR502 and TR506** acting as high voltage plate drivers. The X plate output is also used to derive a focus correction waveform by way of the circuitry including D501 to 504 and **TR509 and** this is applied to a special electrode in the tube.

Blanking and Z Mod

The logic signal corresponding to 'flyback + holdoff' is used to turn on **TR705** which feeds the high voltage transistor **TR706, the Output of** which is coupled to the grid of the cathode ray tube via C720.

Power supply

There are 5 d.c. supply rails. The ±12V rails are derived from the same transformer secondary, and are stabilised using integrated circuit regulators IC701 and 702. The variable current for the twist coil is provided from this part of the circuit by **TR701**.

The +5 d.c. supply is stabilised using **TR605** fed via R650 and R651 from the stabilised +12V rail.

The 275V d.c. supply comes from a separate transformer winding, rectified by a bridge rectifier D706 to 709, and smoothed with π section C703 and 704 with R728 and R729.

The −1850V d.c. tube supply is derived from a tripler fed from another winding on the transformer which is then stabilised by transistors **TR702** to 704, **TR702** acting as a series regulator. P703 allows the regulator to adjust the supply to give 1850V at the tube cathode.

Trigger circuit

The trigger circuit may drive its source from either input channel trigger take-off amplifiers, or from the external input socket. The appropriate source is selected by using the lower two push buttons of the mode selector switches, while unused inputs are decoupled to ground by capacitors to stop spurious triggering. The selected source is coupled to **TR601** which acts as a phase-splitter with in-phase and out-of-phase outputs available at emitter and collector respectively. The desired output is selected by the '+/−' slope push switch and is passed to the AC/TV switch which allows the signal to be routed to a television sync separator circuit formed by **TR602** and then to amplifier **TR603** or direct to **TR603** as required.

The amplifier **TR603** also has a variable bias provided by the trigger level control and passes the amplified and level adjusted signal to comparator IC601. This comparator has positive feedback applied by R624 and R619 giving some hysteresis and a Schmitt trigger effect.

The trigger pulses from the output are passed to the trigger logic circuit via a NOR gate acting as a buffer, in IC603. These triggers clock a D-type flip-flop in IC602 where the D input is held at 0. When clocked the Q output becomes 0 and hence $\bar{Q}$ becomes 1 which initiates a sweep. The CLR and PRE inputs to this D-type when low (active) override the clock. The CLR input is held low for X-Y mode operation to ensure the flyback blanking circuit is disabled.

Triggers from the D-type $\bar{Q}$ output are also fed to an inverter in IC609 which shorts C615 to ground. In the absence of trigger pulses the voltage on C615 rises slowly fed by R634. When this voltage reaches logical '1' a CMOS buffer in IC604 inverts this signal to feed the sweep deciding logic NOR gate in IC603, which in turn allows the timebase to free run. In 'normal' mode a switch shorts C615 permanently to logic '0'. The above conditions control the output of the deciding logic (Pin 1 IC603) which goes low to allow the timebase to sweep and high for flyback and hold-off. The logical expression for pin 1 to be low, and hence allow a sweep is, in terms of pin numbers '2 OR ($\bar{6}$ AND $\bar{5}$)', the equivalent of which in function terms is 'trigger present' or (free run and not flying back plus settling delay).

When the timebase sweeps, comparator IC607 is used to detect both end-of-sweep and end-of-flyback. Its output is normally high, going low at end of sweep, returning high at completion of flyback. The latch formed by half of IC608 together with an inverter in IC609 and the NAND gate in IC604 form a monostable circuit which is timed by R639 and C620 with the addition of C621 at slow timebase speeds. This monostable is triggered by the negative going output of comparator IC607 at the end of sweep. Its timed low going output is connected to the pin 10 PRE input of IC602 which inhibits triggers during the flyback and subsequent settling period.

The monostable high going output feeds through NOR gates in IC603 setting pin 1 high which turns **TR606** on to short out the timing capacitors C623 and C624, causing flyback.
Termination of the monostable timing period will cause a further sweep when in the AUTO mode in the absence of triggers.

Timebase

A constant current source charging a capacitor is used to generate the timebase ramp.

To achieve the different ranges only two timing capacitors are used, the intervening ranges are effected by altering the charging current by resistor selection. IC605 generates a constant voltage across the selected charging resistor. A constant current of approximately 1mA produced by **TR607** and 608 and associated circuitry results in a constant voltage drop across R660. By the action of negative feedback the same voltage appears across the charging resistor selected (R664 to 673) thus attaining a constant charging current into either C623 or C624. IC606 is used to buffer the ramp before applying it to the X preamplifier and the comparator. IC607 which defines the ramp limits at approximately 0V and 5V. The variable timebase is obtained by the front mounted control P605 which can be used to reduce the current from **TR607** from 1mA to 0.35mA slowing the timebase speed.

Channel switch and cal. oscillator

Two buffers in CMOS IC604 and one in IC609 are used with R631, R632 and C614 to form an astable multivibrator running approx 1kHz. The lightly loaded open collector output of IC609 buffer approximates closely to the supply rails and offers sufficient stability for a calibrator. The actual output voltage is trimmed to 1V pk to pk by the potential divider R627 and P602.

A similar oscillator formed by a buffer and a NOR gate in IC604 with C618, R642 and R640 is used as the chopper oscillator, running at approx 200 kHz. The output of this oscillator is used to clock a D-type flip-flop connected in a toggling mode. The outputs from this D-type are used to drive the beam switch circuit. This flip-flop can be jammed into one mode or the other by the use of the preset or clear inputs which can be enabled by the channel select switches or by the X-Y position on the timebase switch. Selection of any of these disables the chopper oscillator via D604 or gates in IC608 and IC609.

At higher timebase speeds, the chopper oscillator is disabled by applying a '0' to pin 6 of IC604 and a '1' to pin 7. This then allows the flyback logic signal from pin 10 of IC603 to be used to clock the beam switch D-type toggle which in turn provides alternate beam switching.

RE-CALIBRATION

Access

To gain access to the internal circuitry the top cover may be removed by unscrewing the two screws on each side near the base of the unit, and then withdrawing the cover rearwards and slightly upwards.

The underside of the main circuit board can be reached by unscrewing the four symmetrically placed screws securing the base plate.

Adjustment of the compensating capacitor of the Y channel input attenuators can be done from the underside of the unit having removed the base plate. If necessary the covers to the screened boxes may be prised off for easier access. However should it be necessary to replace any components on the circuit boards or switches, then the attenuator assembly must be withdrawn through the front panel. This is effected by first slackening the screws affixing the two plastic side cheeks, pulling the cheeks off frontwards and thus releasing the top and bottom trims.

The knobs must be removed. A mixture of collet fixing and push on knobs are used. The escutcheon carrying the front panel legends can then be lifted off. The attenuator module is then removed by unscrewing the four countersunk screws in the corners and withdrawing the assembly through the front panel. It may be necessary to unsolder the wires to the external trigger input socket before complete withdrawal is possible.

CAUTON There are high voltages present within the unit at many points, particularly but not only in the vicinity of the cathode ray tube.

NOTE: The insulating washers used in the mounting of the power transistors on the heatsink flange at the rear are of *Beryllia* which can be *highly toxic* if consumed, or if dust from a crushed or broken washer is inhaled. Take great care when servicing to avoid losing these washers or in the event of disposal treat them as toxic waste.

CALIBRATION

There follows a calibration procedure which will also help in identifying any faults which may develop. Frequent references to a 'scope are not to the unit under test, but to a service 'scope of bandwidth greater than 35MHz to help in the calibration.

Equipment required

Oscilloscope with a minimum bandwidth of 35MHz
Digital voltmeter and suitable high voltage probe
(Farnell DM141 or Data Precision)
Oscilloscope calibrator (Pulsetech)
Levelled signal generator (Tektronix 191)
Pulse generator (Farnell PG101/2)

Switch on and then allow the oscilloscope to warm up for at least ten minutes then check the following:-

+12V between pins 21 and 23	Limits 11.6V to 12.8V
−12V between pins 22 and 23	Limits −11.8V to −12.9V
+275V between C703 and 23	Limits 270V to 285V
−6V between Z601 cathode and 23	Limits −5.9V to −8V
+5V across C22	Limits 4.75V to 5.25V

+12V across C701 - unregulated. Mean d.c. limits +19V to +23V
Ripple <4V pk to pk.

−12V across C702 - unregulated. Mean d.c. limits −19V to −23V
Ripple <4V pk to pk

+275V across C704 - ripple <5V pk to pk

E.H.T. adjustment

Connect the high voltage probe and digital multimeter to pin 43. Switch on and adjust P703 to obtain 1850V as accurately as possible.

Cal. waveform setting

Set Ch.1 to 20mV/Div. Connect probe (X10) to 1V. cal. position (front panel) and check square wave. Adjust P602 on trigger boards to obtain 1V. as accurately as possible. Check that the frequency is 1kHz± 200Hz. If necessary S.O.T. R631.

Chopper oscillator

Set timebase to 1ms/div.
Connect 'scope, probe to IC604 pin 5.
Check oscillation frequency - Limits 200kHz to 280kHz.
Check positive peak >3.2V
Check negative peak <0.5V

Beam switch Flip-flop
Ensure that channel select switches are in the 'on' position (d.c. or a.c.)
Set timebase switch to 50µs/div.
Connect 'scope to IC602 pin 5.
Check square wave at half ramp frequency
Check amplitude is between <0.2V and >4.5V
Connect 'scope to IC602 pin 6.
Check square wave at half ramp frequency
Check amplitude is between <0.2V and 4.5V

Flyback blanking
Connect 'scope to junctions of C720 and R734 etc.
Connect negative going pulse at timebase frequency
Limits:- 12V ±1.5V to 39V±6V

Y-plate mean d.c. adjustment
Set Fine Gain controls to Cal.
Switch off Ch2. Ground Ch1. i.e.
Set front panel Y shift control (Ch 1) to centre of its movement. Connect probes from a dual trace scope to Pins 1 and 2 (o/p to 'Y' plates).
Adjust P1 on attenuator boards (Ch 1) to obtain same voltage on both probes. Adjust P301 to obtain 150V on both probes. Switch off Ch1.
Ground Ch2. Set Ch2 front panel 'Y' shift to centre of its movement.
Adjust P1 on attenuator (Ch 2) to obtain same volts on both probes.

'X' plate d.c. level
Depress both Ch1 select buttons. Depress both Ch2 select buttons.
Turn time-base switch to X-Y. Connect a scope probe to pin 36 and a probe to pin 37. Use X-shift pot on the front panel to obtain same voltage on each probe. Use P503 to adjust voltage on probes to 145V.

Trace rotate and geometry (when C.R.T. has been replaced)
Fit C.R.T. and connect trace rotate wires to the coil and OV to C.R.T. magnetic screens.
Connect signal source to channel 1 (1V pk to pk approx 20kHz) and depress both Ch2 input switches.
Set trigger to Auto
Switch on and adjust Y2 shift to position trace on centre line.
Adjust trace rotate to obtain horizontal line.
Switch off and reverse the trace rotate leads to the coil if a horizontal line is impossible to obtain.
Position the trace to the top graticule line and adjust P502 to obtain as straight a line as possible when trace is adjusted from top to bottom of screen.
Switch Ch1 on with the attenuator on the 0.2V/div. and normal trigger, Ch2.

A vertical line will be displayed on the screen.
Position vertical line at the extreme left and then right hand graticule lines and check that excessive distortion is not present.
Slightly readjust P502 to obtain the best compromise for horizontal and vertical linearity.
Check correctness of operation of channel input switches.

Y-axis ripple rejection
Set the trigger to Auto, Ch1 to 0.2V/div.
Set timebase to 2ms/div.
Depress both Ch1 select buttons.
Switch off Ch2 (both input select buttons out)
Adjust P302 for minimum hum on the trace (minimum vertical ripple)

D.C. gain balance. (DTV12-14 or DTC12)
a. Set Ch1 to 5mV/d iv. Apply 20mV signal from scope calibrator and adjust P2 to give four large divisions. Remove signal and depress both Ch1 input buttons. Set trace to centre of screen with 'Y' shift. Adjust Fine Gain to minimum and back to maximum and note movement of trace from centre position. Adjust P150 so trace moves in opposite direction to movement noted when fine gain was adjusted. Repeat this until no movement is noted (< 1 small div.) when fine gain is adjusted from maximum and minimum and back.
Re-check that 'Y' shift is in centre of movement then adjust P1 on attenuator to put trace in centre of screen. Recheck from A.

b. Repeat for Channel 2 using P250.

Attenuators
Set scope at 5mV div. Apply 20mV signal to Ch1 from calibrator and check good square wave.
Apply 40mV from calibrator. Set scope to 10mV/div. and adjust C9 on attenuator to give best square wave. Apply 80mV from calibrator and set scope to 20mV/div. Adjust C12 to obtain best square wave. Apply 200mV from calibrator, set scope to 50mV/div. adjust C6 for best square wave. Apply 2V from calibrator. Set scope to 0.5V/div. Adjust C2 to obtain best square wave.
Connect 10:1 probe to Ch1. Scope to 5mV/div. Set calibrator to give 4 div. Adjust probe for best square wave. Set scope to 10mV/div. Set calibrator to give 4 div. Adjust C8 on attenuator to give best square wave.
Set scope to 20mV/div. Set calibrator to give 4 div. Adjust C11 to give best square wave.

Set scope to 50mV/div. Set calibrator to give 4 div. Adjust C5 to give best square wave. Check good square wave with 4 divisions at 100mV/div. 200mV/div.

Set scope to 0.5V/div. Set calibrator to give 4 div. Adjust C1 to obtain best square wave.

Set scope to 5mV/div, calibrator to 200mV. Switch scope to A.C. and check the square wave does not change significantly

Ch1 + Ch2 Bias

Check Invert Ch2 button is out.
Check Ch1 + Ch2 button is out.
Ensure Fine Gain pots are in Cal. position.
Set timebase switch to 50µs/div. Adjust both traces to centre of screen.
Depress Ch1 + Ch2 button and adjust P252 so trace is in centre.

Sweep length and fast speed cal.

Set fine sweep control to Cal.
Set timebase switch to 50µs/div. Trigger to Ch1, Ch1 on, Ch2 off.
Set attenuator to 500mV (Ch1). Set bench scope to 100 µs/div. and connect probe to pin 12 (top of R64) on trigger board. Adjust P4 to obtain sweep of 550µs as acurately as possible. Remove probe.

With timebase still at 50µs/div. and attenuator at 500mV/div. apply signal from calibrator to give markers at 50µs repetition rate. Adjust P504 to obtain alignment of markers with tube scale.

Slow speed cal.

Set timebase switch to 5ms/div. Set calibrator to give markers of 5ms repetition rate. Adjust P3 to align markers to tube scale. Press ×5 switch and adjust P506 to obtain X5. Set timebase to 0.5µs. Set calibrator to give markers of 0.5µs repetition rate. Press ×5 switch. Reduce mains by 10% and adjust P503 so that display just does not break up. Re-set mains and depress X5 switch to X1.

Re-check calibration at 50µs and 5ms and then at all timebase positions.

Variable sweep control (DTV12-14 or DTC12)

Set timebase to 50µs/div. Set calibrator to give markers at 50µs repetition rate. Switch timebase to 20µs/div and check that fine sweep pot will adjust markers to more than one per large division.

X-Y Operation

Switch both channels on. Set attenuators to 200mV/div. Apply a sine wave of 1V. pk to pk at 1kHz to both channels. Switch to X-Y position and adjust P505 to obtain line at 45° as accurately as possible.

Bandwidth

Set Ch1 attenuator to 5mV/div. Apply a sine wave from a constant amplitude signal generator. Amplitude set to give 4 large divisions, frequency set at 140kHz. Switch generator to 15MHz.† Adjust C305 trimmer so that display on scope has an amplitude of 2 large and 4 small divisions (i.e. −3dB from original 4 large divisions at 140kHz). Check all positions on Ch1 and Ch2 (from 5mV to 200mV). They should all be no worse than −3dB at 12MHz.

†**IMPORTANT** To adjust C305 with scope switched on use an insulated trimmer tool. This is a high voltage point.

On Ch2 check bandwidth on invert position also.

Set scope to 5mV/div. Timebase set at 0.5µs. Apply a pulse from a pulse generator. Set frequency to 1MHz, width at 0.6µs. Set amplitude to give 5 large divisions on each range. Check overshoot and general pulse response on each range from 5mV to 2V on both channels.

The overshoot should not exceed 5%

Z modulation

Connect a square wave pulse of frequency 1kHz to the Z modulation input on rear panel.
Amplitude of pulse min. OV max.+5.OV
Switch to Auto trigger
Select channel 1
Timebase to 1ms/div.
Check display is blanked at input signal frequency

T.V. trigger

Set pulse generator to 15kHz, 47µs pulse width, and amplitude to give 1 division on screen.
Trigger to normal TV.
Check trigger only possible for timebase speeds 50µs/div. to 0.5µs/div.
Set pulse generator to 50Hz, 150µs pulse width, and amplitude to give 1 division on screen.
Check triggers throughout timebase range.

Ext. trigger

Select Ext. trigger (both Ch1 and Ch2 trigger mode buttons out).
Select norm.
Connect output of signal generator to ext. trigger input socket.
Check triggering at 50kHz - triggers with 1V pk to pk input
Check triggering at 12 MHz - triggers with 5V pk to pk input.

MAINTENANCE

Guarantee

The equipment supplied by Farnell Instruments Ltd., is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of despatch. In the case of material or components employed in the equipment but not manufactured by us, we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to despatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

In the event of difficulty, or apparent circuit malfunction, it is advisable to telephone (or telex) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

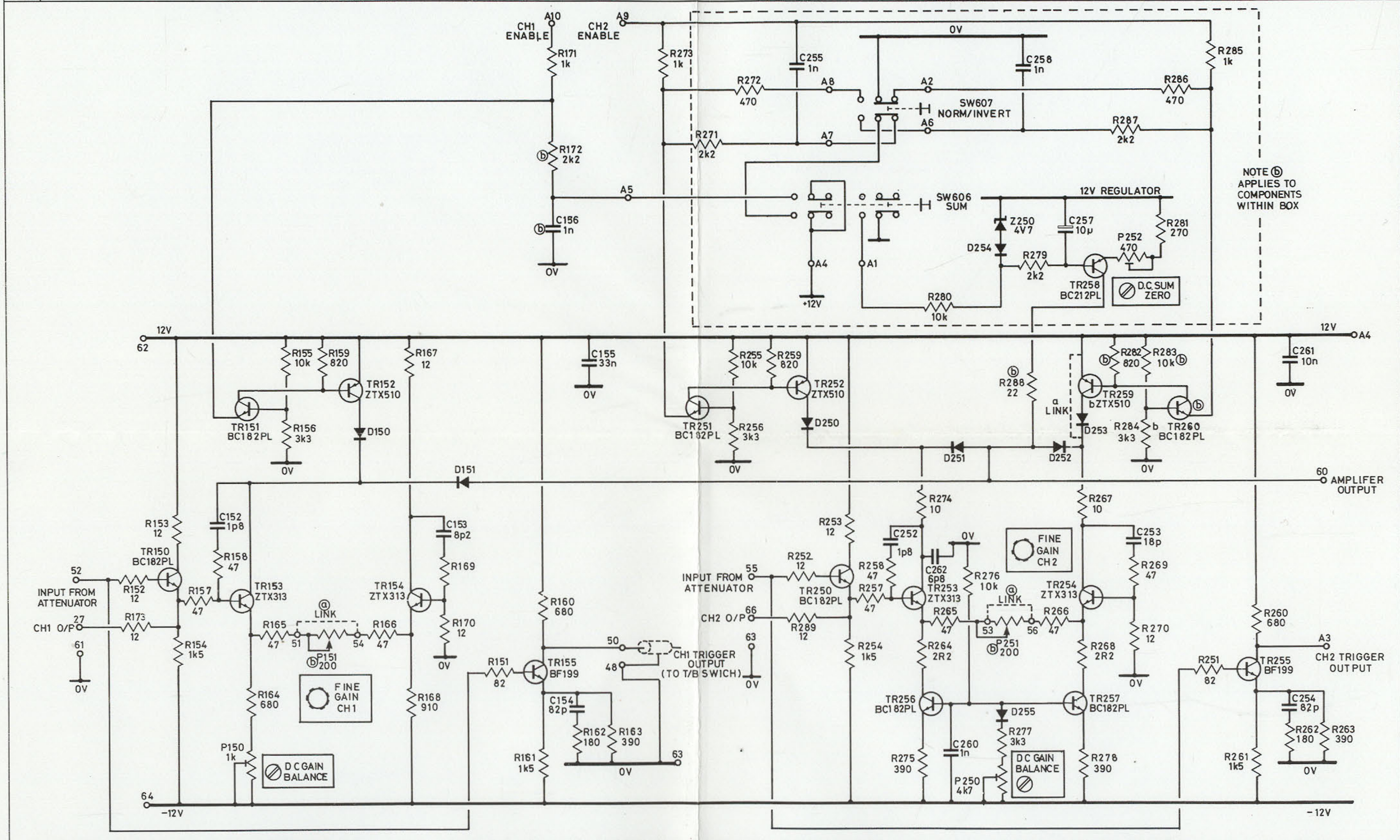
For repairs it is recommended that the complete unit be returned to:

The Service Department,
Farnell Instruments Ltd.,
Sandbeck Way,
Wetherby, West Yorkshire.
LS22 4DH
Tel: 0937 61961 Telex: 557294

Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss. If repairs are to be attempted by the customer these should be undertaken only by personnel conversant with this type of equipment.

NOTES

R	152 153 154 156 155 159 167 169 151 161 160 162 163 272 271 272 252 253 258 275 264 265 277 279 266 268 278 269 270 284 285 260 261 262 263	R
R	173 157 158 164 165 166 168 170 172 171 256 255 259 289 254 257 274 280 276 288 267 282 284 281 251	R
C	152 153 156 154 155 255 252 260 258 257 253 261 254	C
TR	150 151 153 152 154 155 251 252 250 253 256 257 254 268 259 258 260 255	TR
MISC	P150 P151 D150 D151 D250 SW607 D251 SW606 Z250 D254 P250 D255,252,253 P252	MISC



TRACED	ISS.	DATE	MOD. No.	ISS.	DATE	MOD. No.
	A	17-1-83				
CHECKED	B	23.12.83	Q7727			
	B	6.1.84	CR0734			
DRAWN P.G.F.						

NOTES
ⓐ FITTED ON DT12/5 AND DTS12
ⓑ NOT FITTED ON DT12/5 AND DTS12

USED ON:	FACTORY NO	SERIAL NO FROM	SERIAL NO TO
DT12-5	858	1901	
DTV12-14	859	946	
DTC12	966	656	
DTS12	965	51	

NOTE:
CAPACITOR VALUES GIVEN IN μF.
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.
DIODES ARE 1N4148 UNLESS OTHERWISE STATED
03 INDICATES SOLDER PIN NUMBER.

FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: Y AMPLIFIERS WITH FINE ADJUSTMENT CCT.DIA.

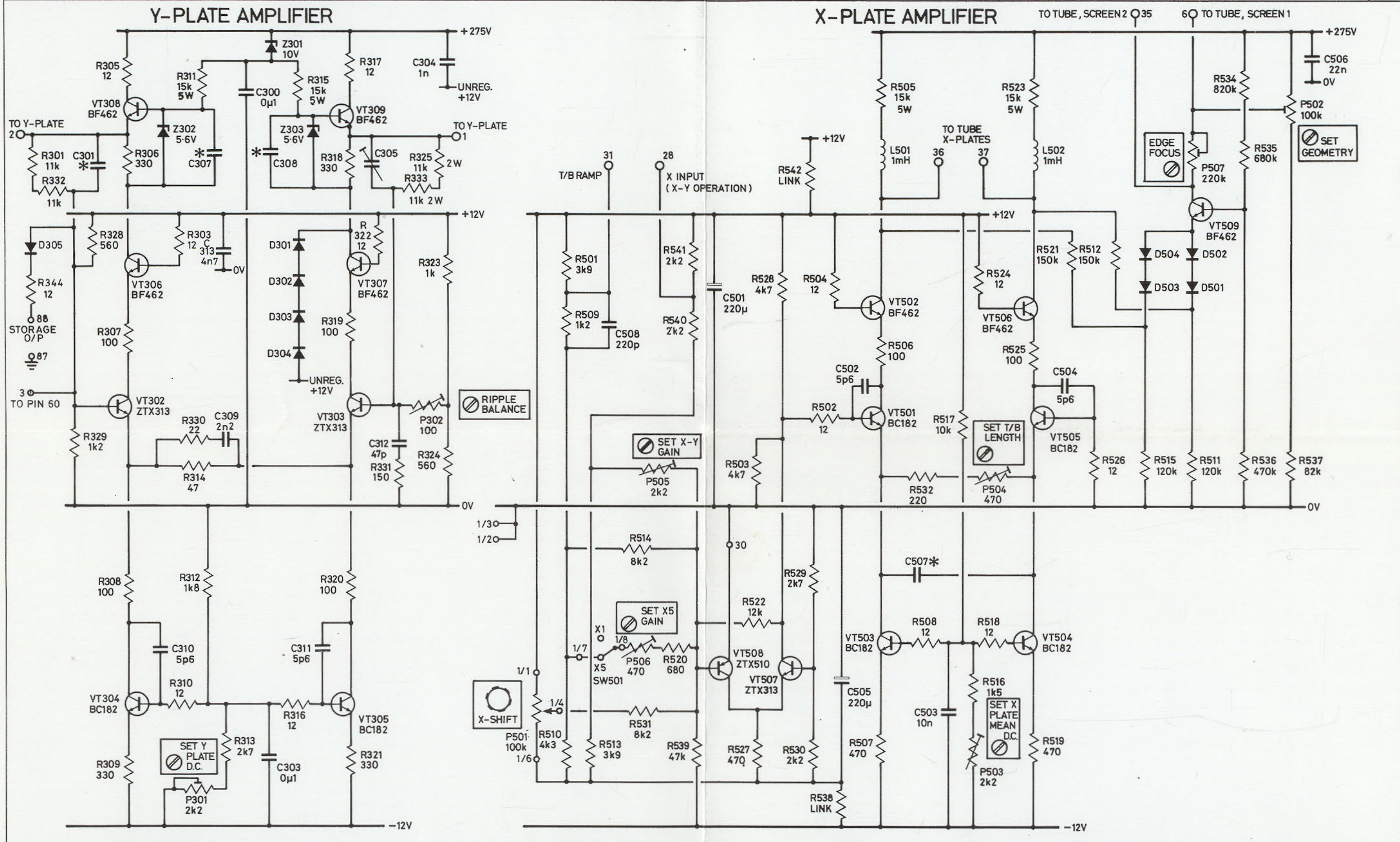
DRAWING No. 2/SZX/0206

SHEET OF SHEETS

GAF 3956 78

Arthur Missira scan

R	301 344 329 305 311 303 313 315 319 321 317 333 323 501 509 513 531 541 531 503 527 529 507 505 517 523 525 521 519 515 511 535 537
R	332 328 308 306 330 310 312 314 316 318 320 322 324 510 514 520 540 528 522 542 504 502 530 506 532 508 524 518 516 512 526 536
C	301 302 310 307 313 300 308 311 306 305 312 304 508 505 502 507 503 504 506
VT	308 306 302 304 303 307 303 305 508 507 503 502 501 506 504 505 509
MISC	D305 Z302 P301 Z301,303 D301,2,3,4 P302 P501 SW8a SW501 P505,506 P504,503 D501,2,3,4 P507



TRACED	ISS.	DATE	MOD. No.	ISS.	DATE	MOD. No.
	A	17.1.83				
CHECKED	B	7.12.83				
DRAWN P.G.F.						

ALL DIODES ARE 1N4148.

*NOT FITTED.

USED ON:	FACTORY NO	SERIAL NO FROM	TO
DT12-5	858	1901	
DTV12-14	859	946	
DTC12	966	656	
DTS12	965	51	

NOTE:
CAPACITOR VALUES GIVEN IN FARADS
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.
03 INDICATES SOLDER PIN NUMBER
1/3 INDICATES SKT1 PIN 3

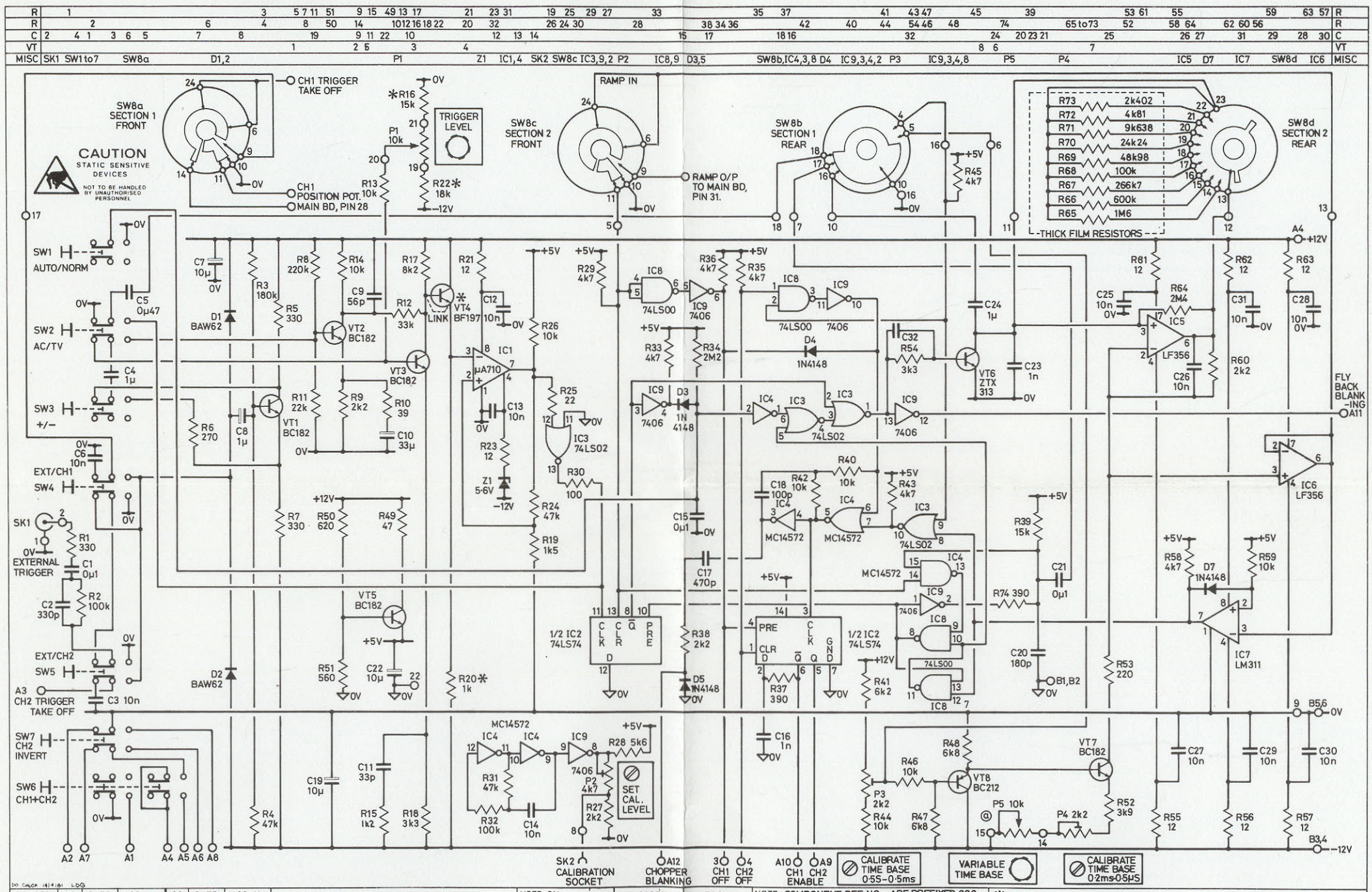
FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: X&Y PLATE AMPS. CIRCUIT DIAGRAM

DRAWING No. 2/SZX/0207

SHEET 1 OF 1 SHEETS

ARTHUR MISSIRA SCAN



TRACED	ISS.	DATE	MOD. No.	ISS.	DATE	MOD. No.
	A	15·5·81	7040	E	21/11/83	Q9193
CHECKED PA	B	9·12·91	Q7491	F	6.1.83	CR0734
	C	15.2.82	Q7555 Q7866			
DRAWN SH	D	9.2.82	Q7782			
	D	13.11.83	CR0686			

* ITEMS NOT FITTED OR VALUES CHANGED.
IC3,8,9 0V PIN 7, 5V PIN 14.
IC4 0V PIN 8, 5V PIN 16

0V DENOTES 0V TO DIGITAL CIRCUITS.
0V " " " OTHER "

USED ON:	FACTORY NO.	FROM SERIAL NO.
DT12-5	858	1401
DTV12-14	859	100
DTC12	966	51

NOTE: COMPONENT REF. NOs. ARE PREFIXED 600.
CAPACITOR VALUES GIVEN IN FARADS.
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.
@ ON DT12-5 P5 NOT FITTED & PINS 15 & 14 LINKED
SW8 SHOWN IN X-Y POSITION

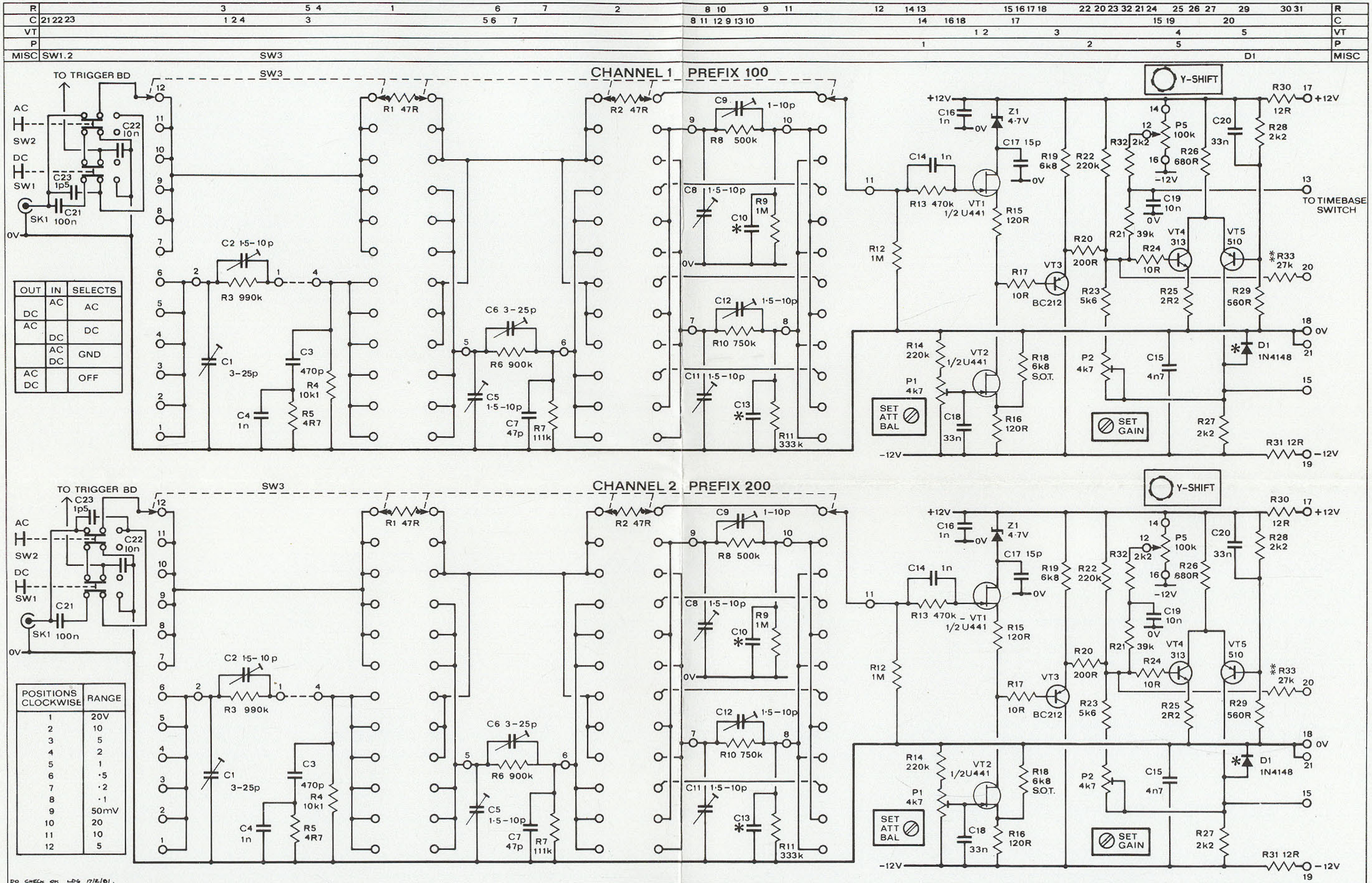
FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: TRIGGER AND TIME BASE CCT. DIA.

DRAWING No. 2SZX0154

SHEET 1 OF 1 SHEETS

ARTHUR MISSIRA SCAN



OUT	IN	SELECTS
DC	AC	AC
AC	DC	DC
	AC DC	GND
AC DC		OFF

POSITIONS CLOCKWISE	RANGE
1	20V
2	10
3	5
4	2
5	1
6	·5
7	·2
8	·1
9	50mV
10	20
11	10
12	5

DO CHECK OK LDG 17/2/81.

TRACED	ISS.	DATE	MOD No.
	A	15.5.81	6668, 7040 7178,
CHECKED	B	11.11.81	Q7200
	C	20.6.82	7040 7781 7782
DRAWN SH	D	21.2.83	Q8385
	E	7.12.83	Q8989

✱ NOT FITTED
SW3 SHOWN IN THE MOST CLOCKWISE POSITION (5mV).
⁑ ONLY FITTED ON DT12C

USED ON:	FACTORY NO	SERIAL NO. FROM	TO
DT12/5	858	1401	
DTV12-14	859	100	
DTC12	966	51	
DTS12	976	51	

NOTE:
CAPACITOR VALUES GIVEN IN FARADS
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.

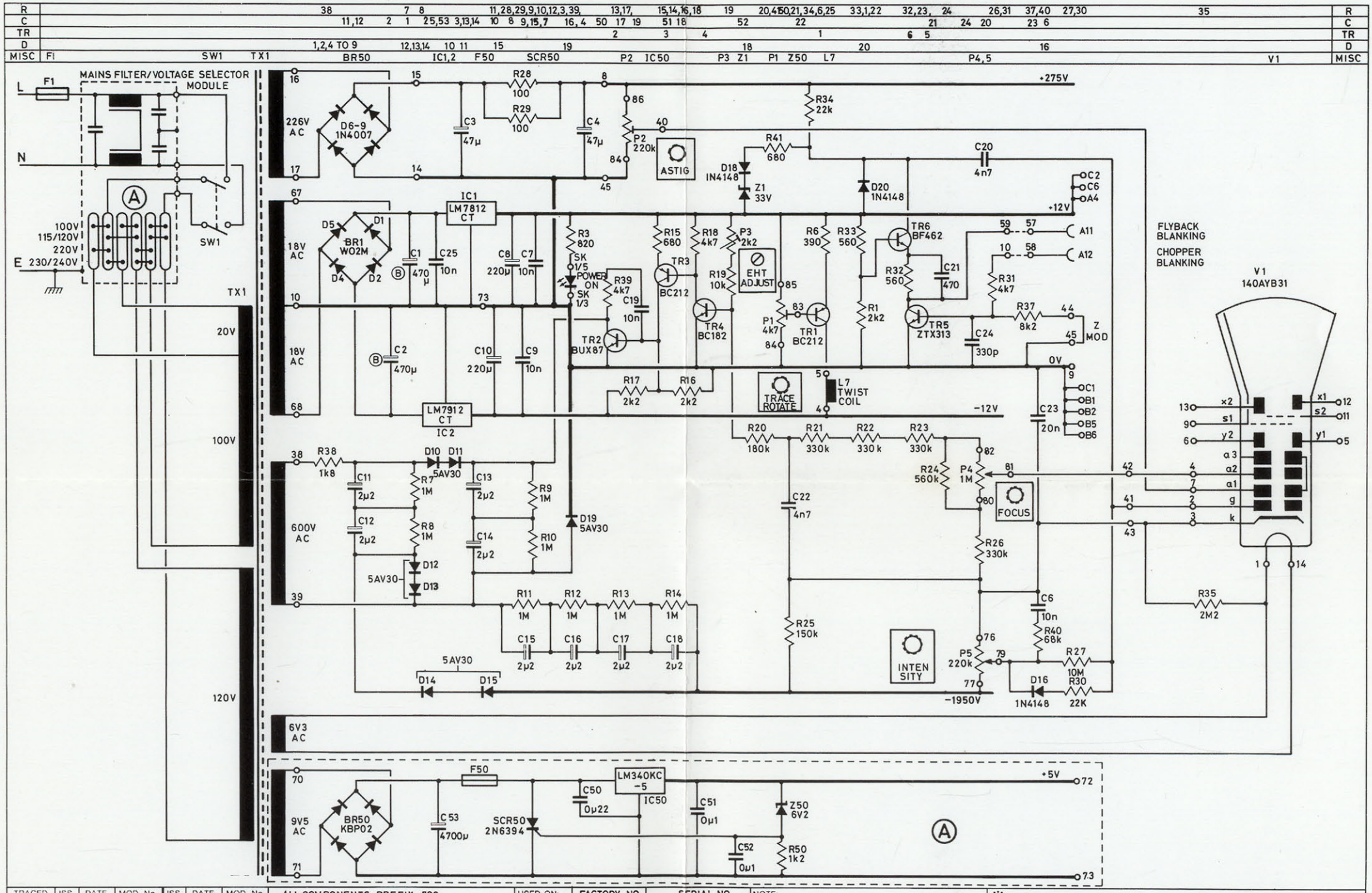
FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: ATTENUATORS & Y-AMPS. CIRCUIT DIAGRAM

DRAWING No. 2SZX0144

SHEET 1 OF 1 SHEETS

Arthur Missira scan



TRACED	ISS	DATE	MOD. No.	ISS.	DATE	MOD. No.
CHECKED						
	C	6.1.84	CR0734			
DRAWN P.G.F.	B	20.12.83	9478			
	A	11.1.83	~			

ALL COMPONENTS PREFIX 700

NOTE
- (A) ONLY FITTED ON DTS12
- (B) C1, C2 ARE 1000µ ON DTS12

USED ON:	FACTORY NO	SERIAL NO FROM	SERIAL NO TO
DTS12	965	51	
DT12-5	858	1901	
DTV12-14	859	946	
DTC12	966	656	

NOTE:
CAPACITOR VALUES GIVEN IN F.
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.

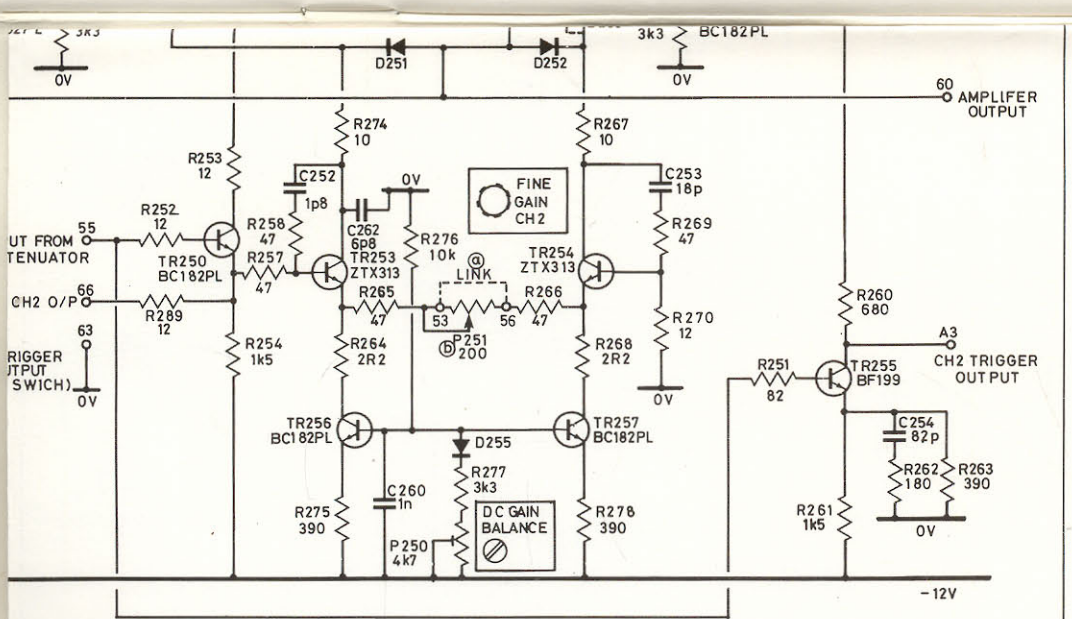
FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: SCOPE POWER SUPPLY

DRAWING No. 2/SZX/0205

SHEET OF SHEETS

ARTHUR MISSIRA SCAN



ERIAL NO	
M	TO

NOTE:
CAPACITOR VALUES GIVEN IN μF.
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED.
DIODES ARE 1N4148 UNLESS OTHERWISE STATED
03 INDICATES SOLDER PIN NUMBER.

FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: Y AMPLIFIERS WITH FINE ADJUSTMENT CCT.DIA.

DRAWING No. 2/SZX/0206

SHEET OF SHEETS

GAF 3956/78

S.

X&Y PLATE AMPS. CIRCUIT DIAGRAM

2/SZX/0207

SHEET 1 OF 1 SHEETS

GAF 3956/78

2SZX0154

OF 1 SHEETS

GAF 3956/78

FARNELL INSTRUMENTS LIMITED - SANDBECK WAY - WETHERBY - YORKSHIRE LS22 4DH - TELEPHONE 0937 61961